Report of
the Task Force
for the Creation of

# Knowledge-Based Jobs


September 2002

# Report of the Task Force for the Creation of Knowledge-Based Jobs

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# Report of the Task Force for the Creation of Knowledge-Based Jobs

## Executive Summary

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The transition to a knowledge-based economy in Arkansas has already begun. Examples of steps taken in this direction can be found in *Appendix II, Positive Trends*. This report seeks to make recommendations concerning how the gaps that remain might be filled to allow Arkansas to compete effectively for retention of our best people to grow knowledge-based businesses and jobs.

The Task Force for the Creation of Knowledge-Based Jobs (the Task Force) has made recommendations in four areas. Those recommendations are summarized below:

### Education

- Elevate math and science education as a whole to the number one public education issue.
- Establish an independent study panel to make recommendations on ways to better allocate, without a significant increase in spending, the state's higher education and supporting infrastructure (K-16) budget.
- Shift resources to degree programs that best address the economic needs of Arkansas.

### Research Centers of Excellence

- Support research as a tool for economic growth and focus research matching funds by establishing no more than six Centers of Excellence.

### Business Formation and Expansion

- Institute a voucher program to provide flexible grants to qualified Arkansas-based business start-ups to help finance fees for professional services needed during the start-up phase.
- Require state pension funds to invest not less than one percent and not more than three percent of their investment pools in the Fund of Funds for early-stage Arkansas technology companies or in Arkansas venture capital funds investing at least 60% of their investments in Arkansas companies.
- Expand the Arkansas Science and Technology Authority's Seed Capital Program.
- Pledge a portion of Arkansas Department of Economic Development's bond guaranty fund to support the Arkansas Development Finance Authority's venture capital fund specifically for Arkansas technology-based companies.
- Provide specific tax incentives for investors in technology start-up and early-stage businesses to invest in Arkansas companies instead of out of state.
- Modify economic development incentives to value people and other intangible assets.

## Policy and Infrastructure

- Create the Knowledge-Based Industries Partnership of Arkansas to recommend and champion actions that will accelerate the creation of knowledge-based businesses and jobs.
- Propose a constitutional amendment to allow equity investment by qualified state agencies.

Together, the above recommendations impact the entire system required to create knowledge-based jobs. This system is illustrated on the following page.

The Task Force believes that a commitment by both the public and private sectors to implement the recommendations of this report will result in substantial and visible progress toward improving Arkansas' competitiveness. It is not a matter of catching up; it is a matter of getting ahead. We have the basic tools necessary to elevate our standing among the states in economic growth and development. We lack a game plan to achieve our goals and provide the type of future we want for all Arkansans. We hope recommendations contained in this report will be included in the game plan and find acceptance by decision makers. We also hope those decision makers will join the authors of this report in making these recommendations a reality.

## Creation of Knowledge-Based Jobs

As indicated in *Figure 1* on the following page, the Task Force believes that if these recommendations are executed, more knowledge-based jobs will be created. This will benefit Arkansas in two important ways:

First, these higher wage jobs will yield higher tax revenues, which will not only repay the investments that were made to create these jobs, but will yield excess tax revenues that can be used to address other state needs.

Second, these higher wage jobs will produce a positive economic impact in their communities. These wage earners will make at least twice the current state average. These earnings will be spent in the local community and will produce an economic multiplier effect as these higher wage earners buy cars, houses, furnishings, appliances, groceries, clothing, services and the myriad of other items on which we all spend our earnings.

The net effect is that the wealth of the state will gradually be raised as the number of knowledge-based companies increases and the number of knowledge workers increases.

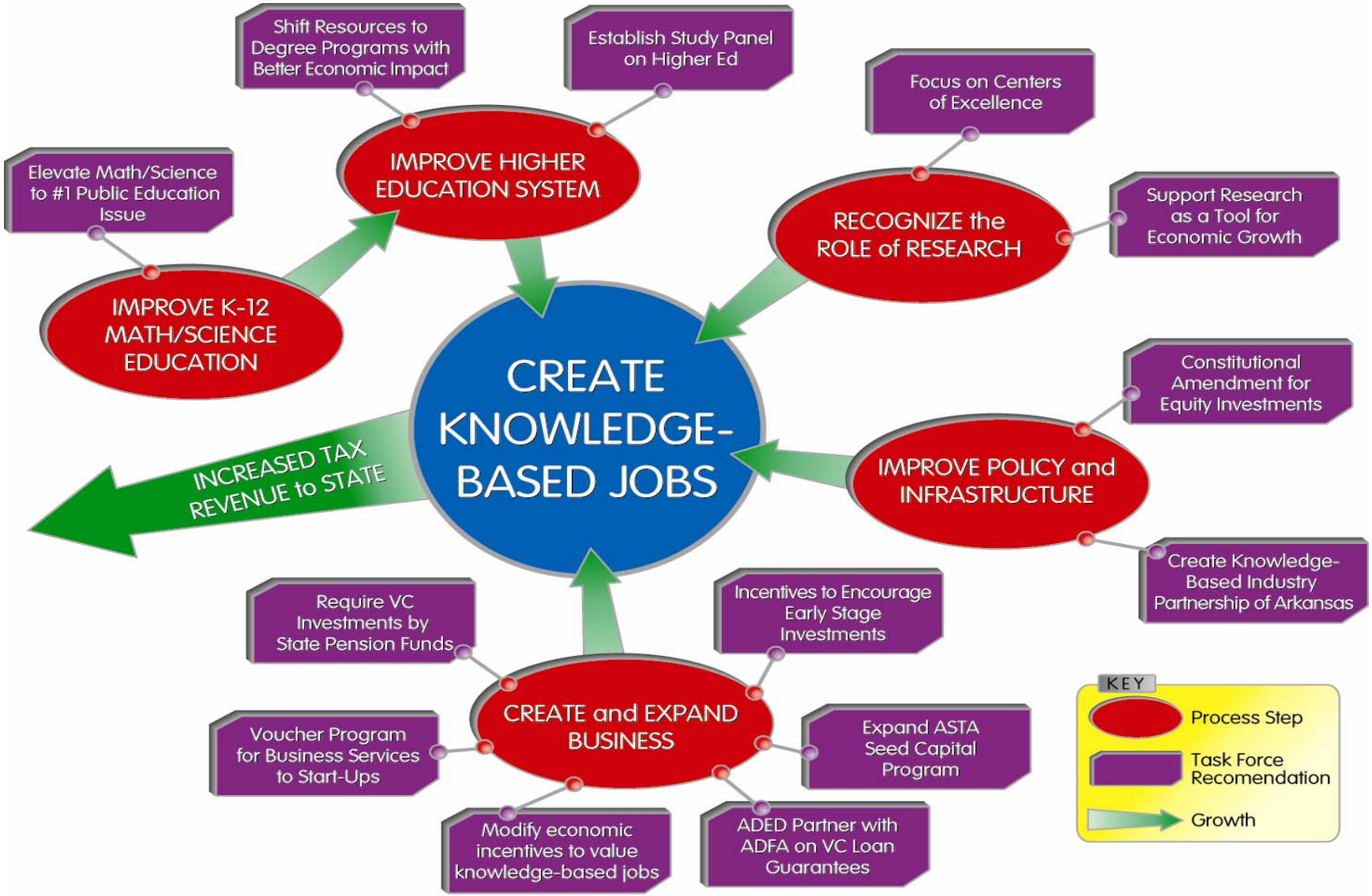


**Figure 1. Recommendations for the Creation of Knowledge-Based Jobs**

# Introduction

The Task Force for the Creation of Knowledge-Based Jobs (the Task Force) was formed by the director of the Arkansas Department of Economic Development in June 2001 as an adjunct to Opportunity Arkansas. Opportunity Arkansas is an effort to establish a state economic development strategy based on regional plans that were initiated at five regional Opportunity Arkansas conferences held simultaneously on July 12, 2001. The Task Force was asked to contribute to this statewide economic development strategy by focusing specifically on knowledge-based job creation.

A knowledge-based company is one that earns revenue in the marketplace through the intellectual activities of its employees who have some form of specialized training and are paid a relatively high average wage compared to the community average (two times the average or greater). This increased wage and spending power ripples through the economy and benefits all citizens of the state. Two-thirds of recent national growth stems from the expansion of knowledge-based businesses.

The mission of the Task Force for the Creation of Knowledge-Based Jobs is:

> To recommend ways to expand the number of knowledge-based jobs and companies in Arkansas. This will be accomplished by:
> 1. increasing knowledge-based employment in existing businesses;
> 2. increasing the number of new knowledge-based start-up businesses; and
> 3. attracting new knowledge-based businesses from outside the state.

The Task Force supports all three routes enumerated in the mission statement for increasing the number of knowledge-based jobs and businesses in Arkansas. However, the Task Force recognizes that our best opportunities rest on our ability to "grow our own" businesses compared to recruiting knowledge-based businesses from out of state.

Much of the work of the Task Force revolved around the discussion of three areas that are critical to the group's mission: 1) education, 2) research, and 3) entrepreneurship/risk capital. Furthermore, there appears to be a logical continuum among these elements that, taken together, weaves strands of math and science education into science and engineering education in colleges and universities, where much (but not all) of the state's research infrastructure is located. This research often leads to new patents for novel discoveries. It is important, where possible, that patents developed in our colleges and universities be licensed to new or existing businesses in Arkansas.

Innovations also come from existing knowledge-based companies, and often these innovative ideas form the basis for a spin-off company. In both instances, a new opportunity for economic development is created, and it is vital that these embryonic knowledge-based startup companies be supported.

Knowledge-based companies go through several stages of evolution. Success is marked by the firms' expansion, infusion of risk capital, and employment of new knowledge workers.

This continuum is illustrated in the following diagram, *Figure 2.* The lower left-hand quadrant of the circle represents public education grades kindergarten through 12th grade. The next quadrant in a clockwise direction represents higher education and university research, followed by a quadrant representing new business creation and growth, followed by the fourth quadrant representing traditional economic development activities. There are two other features on the figure: 1) traditional jobs and knowledge-based companies; and 2) arrows showing different resource flows.

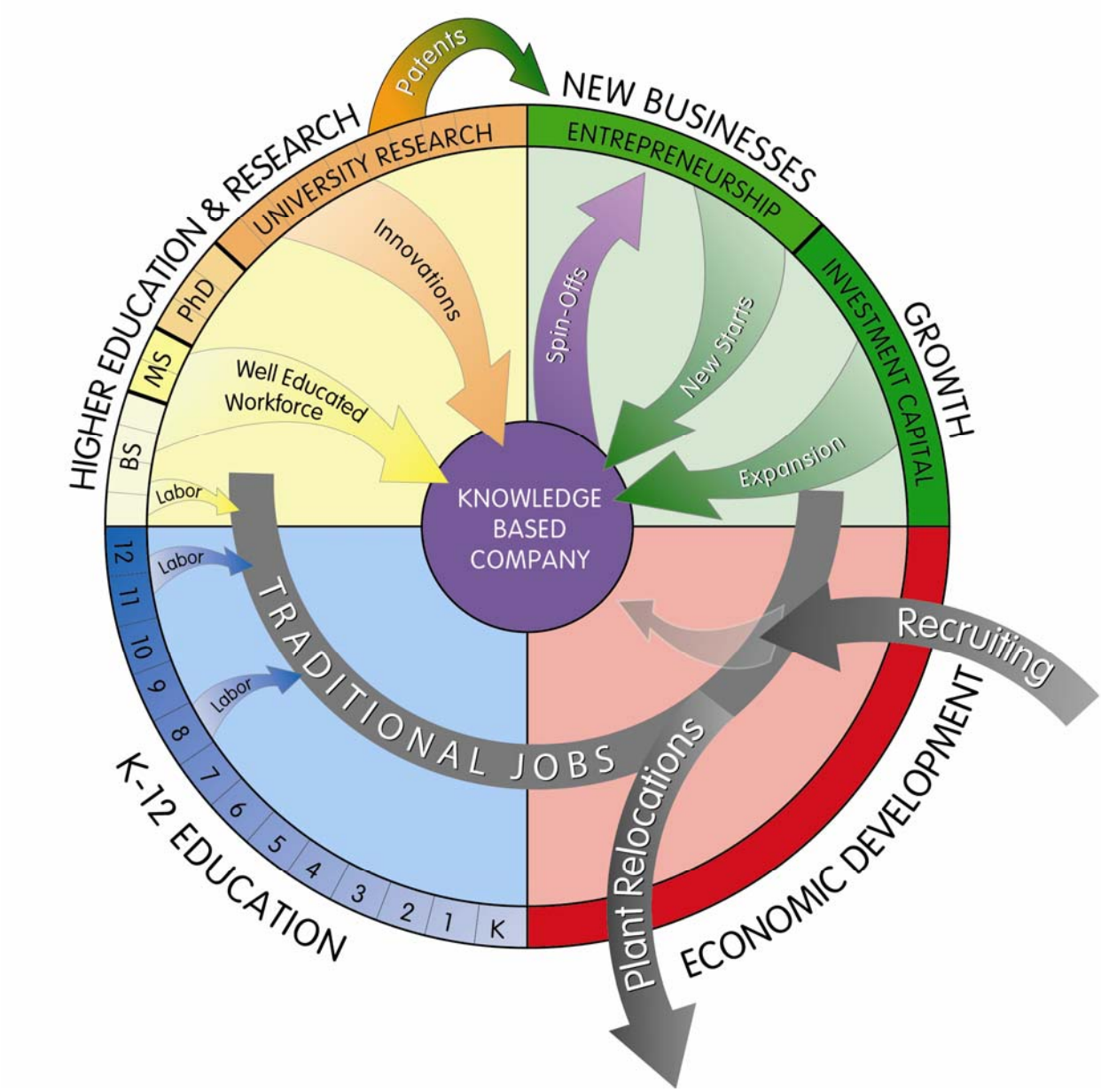


**Figure 2.**
**Process for Creating Knowledge-Based Jobs**

Consider the continuum in *Figure 2* as we trace the Task Force discussions and the evolution of its thinking. The Task Force began in the lower right-hand quadrant with discussions about traditional economic development activities, recruiting companies and the recruiting incentives available. These incentives include job creation tax credits and grants; financing for buildings, land and equipment; and support for training the workforce. Economic developers are familiar with these incentive tools. Upon reflection, the Task Force

concluded that these incentives are the “direct descendants” of incentives for recruiting manufacturing firms and are not, in most cases, offering what knowledge-based companies need to be successful.

When manufacturing firms relocate, they do so to remain competitive by lowering costs, usually labor costs, but also the one-time cost of financing facilities into which they will move and for training a workforce that requires minimal skills. These are not requirements of knowledge-based companies that need highly educated and skilled workers and innovations to incorporate into their products and services. In fact, the Task Force is convinced that many firms recruited today may be the very firms that will close their doors and relocate when competitive forces cause them to seek other locations where labor costs are even lower. The arrows in the Economic Development quadrant of *Figure 2* summarize these conclusions.

Next, the Task Force turned its attention to the other quadrants. It is easiest to consider the next quadrant in the continuum, dealing with K-12 education. The Task Force fully understands the importance and value of public education to knowledge-based companies and the significant demands on public education to graduate students with ever increasing skill levels. The Task Force notes, for instance, that in 1940, the average number of grades completed nationally was eight; in 1970, it was 12 grades; and in 1990, it was almost 13 grades. A high school diploma was better than average at the beginning of World War II and about average when man first landed on the moon.

For more than the last decade, however, a high school diploma was less competitive and illustrates the current gap between high school graduates and the increasing average educational achievement in the nation. It is in this gap that the role of two-year colleges, in the higher education quadrant, has great value. The Milken Institute’s New Economy Index, *(Table 1)* however, does not consider or measure educational achievement lower than the baccalaureate.

In the higher education and research quadrant we see the levels of education and university research on which knowledge-based companies rely. Universities provide both the well-educated workforce (yellow arrow) and innovations (orange arrow) necessary in the new economy. It is the company’s reliance on these critical resources that makes it so difficult to recruit knowledge-based companies to different locations. One line of thought suggests that recruiting incentives entice mostly companies that attempt to compete solely on cost.

Where do knowledge-based companies come from? The Task Force concluded that they must be created and grown, as shown in the new business and growth quadrant. New knowledge-based companies (first green arrow) coalesce around intellectual property (the orange and green patents arrow pointed from university research to entrepreneurship) and entrepreneurs or spin-offs (purple arrow) from existing knowledge-based companies. Under favorable market conditions and with the infusion of investment capital, such companies expand (second green arrow).

The Task Force notes that the Milken Institute's New Economy Index *(Table 1),* which includes 12 measures of the new economy, tracks the continuum with three education metrics (the lowest of which is the baccalaureate), four research metrics, one intellectual property metric, three new business metrics and exports.

The Milken Institute's policy brief titled *Blueprint for a High-Tech Cluster*[1] by Ross C. DeVol concisely describes the elements needed to create "cutting-edge industrial clusters." Among those elements are the following:

- Research facilities;
- Costs of doing business;
- A trained/educated workforce;
- Nearby outstanding educational institutions;
- A network of suppliers;
- Technology spillover;
- Venture capital;
- Quality of place; and
- Cost of living.

Clusters of industries built on these elements, according to DeVol, "are determining which metropolitan areas and states are achieving superior economic growth or falling behind." With knowledge about such elements, the Milken Institute developed the New Economy Index[2] to assess how well the states are faring in the new economy.

The indicators used in the New Economy Index are worthy of careful review. It is significant that the Index is made up of three educational indicators, four research indicators, patents, three new-business-related indicators, and exports. In the new economy, the things that matter most are college, graduate science and engineering degrees, research, intellectual property, new business starts and expansions, and participation in global commerce.

**Table 1.**
**Milken Institute's Indicators and Metrics for the New Economy**

| No. | Indicator | Metric |
|---|---|---|
| 1. | Educational Attainment | Percent of Population 25+ with BA or Greater |
| 2. | Educational Attainment | Percent of Population 25+ with Advanced Degree |
| 3. | Doctoral Scientists & Engineers | Percent of Population |
| 4. | Academic R&D | Dollars Per Capita |
| 5. | Federal R&D | Dollars Per Capita |
| 6. | Industry R&D | Dollars Per Capita |
| 7. | Patents Issued | Per 100,000 |
| 8. | Business Starts | Per 100,000 |
| 9. | SBIR Awards | Per 100,000 |
| 10. | VC Investment | As Percent of GSP |
| 11. | IPO Proceeds | As Percent of GSP |
| 12. | Exports | As Percent of GSP |

The Task Force cannot overemphasize the importance of taking immediate actions to increase knowledge-based employment in the state. On almost every ranking based on economic development indicators, Arkansas is near the bottom. Significant changes must be made to improve these standings, not just to elevate Arkansas in the ranking, but because changing underlying performance is essential to the state's long-term

[1] *Blueprint for a High-Tech Cluster: The Case of the Microsystems Industry in the Southwest*, by Ross C. DeVol (Policy Brief Number 17, Milken Institute, August 8, 2000)
[2] See http://www.milkeninstitute.org/releases/capital.html for state rankings.

economic well-being. To do nothing is a formula for failure. Current and future generations of Arkansans are depending upon decision makers to set a course that will result in the availability of high quality, knowledge-based jobs for our children so they will not have to leave Arkansas to reach their potential. As an ancient Chinese proverb observes, “If you don’t change direction, you are likely to wind up exactly where you are headed.”

Supplemental to the recommendations contained within the body of this report are four recommendations found in *Appendix I*. The Task Force chose to focus on the recommendations found within the four major subject headings, but felt strongly that the four recommendations in *Appendix I* are also important recommendations which should be considered.

*Appendix IV* lists the names of the Task Force members who have spent numerous hours in discussions leading to the issuance of this report.

# Education Recommendations

Education and the development of a culture that promotes and supports lifelong learning are at the core of economic development. Over the past year, many of the discussions of the Task Force centered on the importance of education and the need for educational improvement in developing knowledge-based businesses and creating jobs for knowledge workers. Most of the discussions focused on the impact of higher education and its research infrastructure on this development. However, the Task Force was quick to recognize that the benefits of education are cumulative, and without a strong and vibrant K-12 educational system, the potential economic impact of universities is severely diminished.

In 2001, the Arkansas General Assembly authorized the establishment of the Arkansas Blue Ribbon Commission on Public Education. This group worked diligently to develop a plan for K-12 public education in Arkansas. Rather than duplicate the work of the Commission, the Task Force applauds its work and supports the thrust of its recommendations, which were published on July 18, 2002.

The Task Force has identified some ideas and principles about public education that it elevates to a level of special importance:

**1.** Elevate math and science education as a whole to the number one public education issue**.**

First and foremost, any recommendations for educational improvement must go beyond mere minor adjustments to the way we educate students in mathematics and science. Recommendations should encompass the breadth and range of the systemic transformation that has washed through virtually every other sector of the economy. The premise for each recommendation should be that its implementation will transform education in a significant and measurable way, making the educational enterprise more effective and efficient. The Task Force suggests that the way K-12 education is currently being delivered is the consequence of efforts to maintain the features of agricultural and industrial-age organizations, rather than to incrementally improve an information-age learning organization.

Recommendations to improve public education must recognize the fundamental importance of innovations in the economy and the clear relationships between 1) the innovations, university research capability, and science and engineering professionals on the one hand and 2) a robust K-12 math and science education on the other. The two must go together.

Congressman Vernon J. Ehlers described this relationship in his May 15, 2002, testimony before the Committee on Appropriations, Subcommittee on Labor, Health and Human Services and Education. In addressing the importance of science, math, engineering, and technology (SMET) education, Congressman Ehlers said:

> We are a nation fueled by advances in science and technology. The tremendous economic growth and productivity gains of the past decade can be directly attributed to our nation's scientific enterprise, and advances in technology continue to transform the way we live and work.
>
> The economic growth and productivity gains our nation has recently enjoyed will not be sustainable if our schools do not produce a scientifically literate workforce.

The Task Force informally shared preliminary thoughts about SMET education with the Blue Ribbon Commission prior to the conclusion of the Commission's deliberations. These are included in *Appendix III*.

While the Task Force was careful in its approach to making recommendations about K-12 education and wants to avoid duplicating the work of the Commission, there is one area where it perhaps has an even stronger view than did the Commission.

The Task Force recommends elevating math and science education as a whole to the number one public education issue. Specifically, at the K-12 level, the integration of higher-order cognitive skills, hands-on, discovery-based learning and quantitative skills into the overall curriculum is imperative. The use of student exhibits and competitions that promote and highlight student participation in math and science activities, e.g., science fairs, science Olympiads, math day contests and pre-engineering competitions, should be stressed. Also, the practice of not allowing middle school students to participate in the statewide science fair competition held each year on the campus of the University of Central Arkansas should be changed so that middle school regional science fair winners can go on to compete at the state level as do their high school counterparts. Finally, academic achievement must be celebrated at the same level as other student accomplishments such as athletics and music.

2. Establish a small, independent study panel to make recommendations on ways to better allocate, without a significant increase in spending, the state's higher education and supporting infrastructure (K-16) budget.

Building on the work of the Blue Ribbon Commission on Public Education and the Task Force's findings about education, the Task Force recommends that a small, independent study panel be commissioned to make recommendations on ways to better allocate, without a significant increase in spending, the state's higher education and supporting infrastructure (K-16) budget. The study panel should adhere to, but not be limited to, the following principals:

- Tie funding to achievement of measurable, stated goals; and
- Focus on reducing competition and redundancies in two and four year institutions.

The Task Force bases this recommendation on several observations.

First, the structure of the current higher education system in Arkansas differs significantly from the structure found in other states. For instance, Arkansas is ranked second among the states in the ratio of public to private institutions of higher education. This means that our public colleges and universities educate a disproportionate percentage of students when compared with other states. Also, there are only four states that have a higher ratio of two-year institutions per capita of college/university

population. Our high number of two-year schools appears to create redundancies among college and university degree programs. These facts, in parallel with the large number of local public school systems in the state, create concerns for the Task Force about how higher education, as well as K-12 education, can optimize financial and operational efficiencies.

On the other hand, the Arkansas Association of Two-Year Colleges has established and supports the nine regional Cisco Academies, each of which supports 10 local academies either at two-year colleges or high schools, creating a seamless transfer from high school to college or work. This is a model that could be replicated for other technical programs. The state has the chance to structure the system differently and to structure it correctly if it looks carefully and thoughtfully at education as a seamless system. The economy of the state depends on being able to prepare well-educated workers.

Second, the competition between public two-year and four-year institutions of higher education must be addressed, especially in the areas of science and mathematics, where two-year schools appear to be at a disadvantage regarding appropriate faculty, instructional facilities and equipment, the lack of which create problems for transfer students who enter four-year programs. Lack of adequate preparation for higher-level science and math courses offered at four-year institutions can lead to withdrawal from those programs due to academic underachievement.

Third, there is the financial challenge that all states face with limited resources and increasing opportunities. And while it is true that Arkansas dedicates a large share of its resources toward the education of its population, the data plainly show that the state continues to lag behind the national averages in terms of percentage of population with an undergraduate or an advanced degree. A clear focus on excellence in higher education is critical.

3. Shift resources to degree programs that best address the economic needs of Arkansas.

While it is very difficult to think about spending an even larger share of our total state budget for education, it is not so hard to think about spending the current share in a more effective and efficient way. The Task Force is concerned that colleges and universities are promoting redundant degree programs that, in some cases, are not economically beneficial to our state. Colleges must develop means and methods of working with each other and sharing resources so that expensive resources do not have to be unknowingly duplicated. Degree programs that have little economic benefit to the state and which produce excess graduates who are not readily employable should be reduced in number and funds directed to programs that will have a more positive economic impact for our state. The key question is whether the state should invest dis-proportionately in redundant degree programs when there will not be jobs for these graduates. That investment could and should be better and more effectively directed.

Lastly, there are many important needs throughout the education system, but the Task Force is hesitant to single out any particular one. The Task Force, however, discussed at length UALR's Donaghey College of Information Science and Systems Engineering (the CyberCollege) as an innovative example of how the state's knowledge-based companies drove the creation of a set of degree programs that provide rigorous educational opportunities linked to the business community's need for information

technology and computer science graduates. In general, this demonstrates a positive contribution by a university to the needs of the business community. If there is any flaw in this model, it is the lack of a policy process that ensures adequate ongoing support for the CyberCollege, which needs permanent base-level funding.

The Task Force has raised questions, based on these kinds of strategic concerns and observations, and suggests that a Blue Ribbon Commission on Higher Education could develop answers and recommendations on these important issues. The agenda for such a commission could include, among other things, a focus on excellence in education, affordability, growth in enrollments, the relationship between two-year and four-year degree programs, the emphasis and focus on research, and information technology (IT) literacy as part of all higher education disciplines.

The challenge, especially difficult in a term-limited legislature, is to use information to build long-term support for Arkansas' statewide system of higher education when legislators seem to be faced with local interests and shorter terms. It seems to the Task Force that the private sector has an important role to play on such a commission because of the influence it has on the political system and because industry can be effective in calling for and supporting the creation of innovative new initiatives such as the CyberCollege at UALR.

**Summary of Education Recommendations**

1. Elevate math and science education as a whole to the number one public education issue.

2. Establish a small, independent study panel to make recommendations on ways to better allocate, without a significant increase in spending, the state's higher education and supporting infrastructure (K-16) budget.

3. Shift resources to degree programs that best address the economic needs of Arkansas.

# Research Centers of Excellence Recommendations

1. Support research as a tool for economic growth and focus research matching funds by establishing no more than six Centers of Excellence.

The Task Force recommends a major, ongoing effort to increase the amount of research conducted at institutions of higher learning in Arkansas. The Task Force found in its discussions that research is central to future economic development because the results of research provide the two critical needs of knowledge-based companies: research innovations and highly educated workers. It is well established that research and patents that result from research form one of the bases for high-quality economic development.

The amount of research conducted at the University of Arkansas for Medical Sciences and the University of Arkansas, Fayetteville has increased significantly during the past 20 years, but Arkansas still lags behind other states in this area. Therefore, increasing the amount of research conducted at our universities should be a major priority for Arkansas.

The fact that a significant part of the tobacco settlement money was committed to research indicates that Arkansas recognizes the importance of research in economic development. Arkansas needs a research model for accelerating high-wage, high-quality economic development. Creation of a large research base, coupled with a program to speed the development of knowledge-based companies specifically set up to license patents emanating from this research base, represents an excellent route for high-quality economic development. There are examples in other states of how research coupled with a business accelerator process can accomplish these results.

The Task Force finds that three ingredients are needed to increase the amount of research at Arkansas universities:

1. Research universities must have a robust physical infrastructure in which research can be done.
2. Research universities must have nationally competitive scientists and engineers to conduct the research.
3. Research universities must be able to compete successfully for the external sponsorship that financially supports research projects.

The Task Force findings indicate that there are a small number of campuses in the state with robust research infrastructure and there are fine, nationally competitive researchers in Arkansas. The primary limiting factor is external support. This suggests that the most expedient way to increase the amount of research is to increase external support for research.

Most external support comes from federal agencies, with potentially significant secondary support from industry. Both sources are attempting to leverage their finite resources by requiring matching funds from state or university resources, which are often limited or nonexistent. The Task Force believes that Arkansas must find a way to meet these matching requirements for larger-scale federal and industry-driven research if it is to be competitive in the new economy.

The Task Force recommends that, in addition to the smaller scale research support for young researchers, the state support large-scale, externally supported research by targeting a limited number of "strategic" research areas and focusing state matching funds on selected "Centers of Excellence" where Arkansas has a clear opportunity both to excel at research and create economic growth based on that research.

Supporting Centers of Excellence with matching funds is an approach that focuses available resources on areas having the greatest potential for the state. Like many other states, Arkansas' resources are limited. It is therefore important not to dilute resources by investing in a large number of areas, none of which receives adequate funding, just to satisfy the research agendas of individual researchers, campuses or federal agencies. Rather, state funding of Centers of Excellence should target initiatives that have the potential to be nationally recognized within a three- to five-year period and generate intellectual property and students needed by knowledge-based companies.

The Task Force recommends three Centers of Excellence that would target research to benefit existing knowledge-based industries in Arkansas:

1. Biotechnology and medical technology;
2. Information technology; and
3. Agriculture and food sciences.

The Task Force also recommends three Centers of Excellence that would target research that has the potential to spin off new entrepreneurial knowledge-based companies serving new markets with new products:

1. Agricultural medicine;
2. Bioinformatics and computational biology; and
3. Nanomanufacturing and photonics.

**Summary of Research Recommendations**

1. Support research as a tool for economic growth and focus research matching funds by establishing no more than six Centers of Excellence.

# Business Formation and Expansion Recommendations

After potential entrepreneurs and employees receive a good education, and after research institutions or businesses spawn ideas for new businesses, these new enterprises must be organized, capitalized and become operational. After becoming operational, they must grow and generate more knowledge-based jobs.

Currently, there are several incentives in Arkansas that support this process, but many of them are tied to companies hiring large numbers of employees rather than to small, start-up technology companies. These companies can grow to be large employers but tend to start small. With Systematics (ALLTEL Information Systems), or Acxiom as examples, we can see that by creating small technology start-ups, we can, over time, generate large employers of highly paid knowledge workers.

Recommendations to encourage the creation and expansion of such firms follow:

1. Institute a voucher program to provide flexible grants to qualified Arkansas-based business start-ups to help finance fees for professional services needed during the start-up phase.

These vouchers would be issued only to qualified knowledge-based businesses located in Arkansas. Professional help contemplated under the voucher program includes, but is not limited to, assistance developing a business plan; legal help securing patent protection; accounting help establishing a set of books or an accounting system; legal help with incorporation, tax and regulatory compliance; and help developing market information and a marketing plan. The voucher program might be implemented by the Arkansas Department of Economic Development (ADED) as part of the agency's Small Business Program, by the Small Business Development Center (SBDC) or by the Arkansas Science and Technology Authority (ASTA).

A qualified entrepreneur would apply for vouchers that could be used to help pay for critical needs, which will vary based on circumstances. Some entrepreneurs may need help developing a business plan, while others may need help developing market research or raising capital. Some entrepreneurs may need help setting up accounting systems, while others need help incorporating their business, developing an offering memorandum, filing for a patent or other such activities. The voucher program would provide a flexible grant to early-stage knowledge-based companies to help pay for services in these areas.

The proposed grant would be limited to $15,000 (escalating 3 percent annually) and would be paid upon presentation of invoices for work performed by certified service providers. A review committee consisting of experienced business persons would review and approve grant applications. No more than two grants should be approved for the same company.

The agency responsible for administering the voucher program would also be responsible for establishing criteria for certifying service providers. In some cases,

criteria will be easy to establish; for example, CPAs could be deemed certified to establish a set of books or an accounting system. In other cases, such as assistance developing business plans, certified service providers should be required to show evidence that they have received professional education that qualifies them to provide services in the area in question.

2. Require state pension funds to invest not less than one percent and not more than three percent, of their investment pools in the Fund of Funds for early-stage Arkansas technology companies or in Arkansas venture capital funds investing at least 60 percent of their investments in Arkansas companies.

3. Support an extension of the Arkansas Science and Technology Authority's Seed Capital Program. Expansion includes the following:
   a. Establish a second fund, with funding of $5 million a year for five years, to make investments based on knowledge-based companies' valuations rather than traditional banking criteria. The criteria for such awards would be based on such things as people assets and intellectual property assets.
   b. Increase funding for ASTA's Seed Capital Program by $4 million.
   c. Qualfy ASTA's Seed Capital Program as a venture capital fund under ADFA's Fund of Funds (would require constitutional amendment; see second recommendation under "Policy and Infrastructure").

4. Pledge a portion of ADED's bond guaranty fund to support ADFA's venture capital fund specifically for Arkansas technology-based companies.

5. Provide specific tax incentives for investors in technology start-up and early-stage businesses to invest their money in Arkansas companies instead of out of state.

For example, Act 1584 of 2001, which allows a capital gains tax exemption for certain investments, needs to be expanded to include a broader range of technologies. Also, Section 1244 of the federal tax code (that allows losses to be applied against income as well as against capital gains) should be applied to the Arkansas tax code for technology start-up and early-stage businesses.

6. Modify economic development incentives to value people and other intangible assets.

Incentives should be targeted toward payroll, providing faster assistance up-front, research and the value of intellectual property and other assets not currently considered as collateral.

## Summary of Business Formation and Expansion Recommendations

1. Institute a voucher program to allow qualified knowledge based business start-ups to access needed help (business plan development, patent assistance, accounting, legal, etc.) to establish new, knowledge-based businesses.

2. Require state pension funds to invest a certain percentage of their portfolio in the venture capital Fund of Funds managed by ADFA.

3. Support an expansion of the Arkansas Science and Technology Authority's Seed Capital Program. Establish it as a venture capital fund under ADFA's Fund of Funds.

4. Allow a part of ADED's Bond Guaranty Program to be used to support ADFA's venture capital effort.

5. Provide specific tax incentives to promote early-stage investment in new Arkansas businesses.

6. Modify economic development incentives to value people and intellectual property assets.

# Policy and Infrastructure Recommendations

1. Create the Knowledge-Based Industries Partnership of Arkansas to recommend and champion actions that will accelerate the creation of knowledge-based businesses and jobs.

The Task Force recommends the creation of a private, non-profit organization, the Knowledge-Based Industry Partnership of Arkansas, dedicated to helping Arkansas accelerate the formation of knowledge-based employment in the state.

The vision of this organization is to become THE model collaborative engine for innovation among business, education, government and the capital markets to accelerate Arkansas' participation in the knowledge-based economy.

As depicted in the graphics in *Figure 1 and Figure 2* of this document, there are a number of critical "moving parts" in the overall process of building, developing and maintaining a strong business formation process for knowledge-based businesses. It will be the intense focus of this organization to make sure that these critical parts are monitored and move in harmony.

This organization will need at least five years of funding to get this process underway. It is yet to be determined whether this organization will be built of specific businesses becoming "partners" and providing funds in that manner or built on other private funding sources.

It will take strong private leadership to get the proper focus on this organization, but it is strongly felt by the Task Force that such leadership is available and fully capable of responding to the call.

The purpose of this organization is not to replace an existing organization, but to fill a void that exists at present. In order for Arkansas to have a place in the knowledge-based economy, Arkansas must be efficient and effective in using its limited resources. Consequently, it must focus on leveraging its investments to maximize the impact of key elements in the life cycle of building knowledge-based industries in our state and to optimize the relationship between key parts in the process.

This must be a private-public sector partnership with full cooperation and communication with all of the key constituents. A key objective is to effectively use the state's intellectual resources to benefit business formation around high-salary jobs and businesses that will increase the tax benefit to the state.

The Knowledge-Based Industries Partnership of Arkansas will, among other things:

1. Recommend and promote specific knowledge-based policies and procedures relative to the advancement of knowledge-based priorities.
2. Evaluate the needs of knowledge-based industries and recommend standards that impact the design of programs for K-12 and higher education.

3. Develop metrics that monitor the state's progress in competing in the knowledge-based economy.
4. Champion research and technology development initiatives at our research universities that mirror the strategic needs of knowledge-based companies in Arkansas. This includes building strong "bridges" between knowledge-based businesses and university research Centers of Excellence.
5. Champion the creation and incubation of new businesses derived from research or entrepreneurial activity.
6. Champion the acceleration of venture capital funds' formation for investment in knowledge-based companies in Arkansas.
7. Build strong relationships within state government with those agencies that are critical to the success of knowledge-based industry development in Arkansas.
8. Monitor and recommend appropriate policies and programs that may have been employed in other states.

The governing board for this non-profit must include leaders from both the private sector and governmental entities that are critical for the overall success of this partnership effort.

Stated simply, the mission of the Knowledge-Based Industries Partnership of Arkansas is to accelerate the integration of university research, capital formation and business development to increase job creation in Arkansas that will elevate the income of the individual citizens of Arkansas while allowing Arkansas to compete intelligently in the global economy.

The measure of success will be based on key metrics that the Partnership will develop. These metrics will be generally accepted on a national scale so Arkansas can legitimately measure its movement toward or away from its stated goals.

2. Propose a constitutional amendment to allow equity investment by qualified state agencies.

The Task Force recommends submitting to the voters a constitutional amendment that would allow qualified state development or science agencies (i.e. ADFA, ADED and ASTA) to take equity positions as part of their existing economic development programs. This would allow a method by which economic development funds, such as Seed Capital Investment Fund at ASTA, to increase over time, based on equity returns from highly successful companies.

**Summary of Policy and Infrastructure Recommendations**

1. Create the Knowledge-Based Industries Partnership of Arkansas (KBIPA) to recommend and champion actions that will accelerate the creation of knowledge-based businesses and jobs.

2. Propose a constitutional amendment to allow equity investment by qualified state agencies.

# Final Thoughts

There are many benefits to be gained from increasing the state's reliance upon jobs requiring higher levels of education. For instance, the impact of more knowledge-based companies and knowledge-based jobs should help address other challenges that are derivatives of low-wage or small, labor-intensive companies, such as lack of available health insurance. Companies that have higher paying jobs should provide their employees a higher level of benefits and consequently improve the quality of life for its employees and the state. Other benefits, such as image enhancement, clustering of knowledge-based companies with similar interests, and increased tax revenues should result from targeting jobs that are knowledge-based.

There have been many reports issued over the years that seek to improve Arkansas' standing in education, economic development and other areas where improvement may be desired. It is very clear that it is going to take more than the issuance of a report to change the way we do things. The Task Force for the Creation of Knowledge-Based Jobs hopes that the readers of this report will find merit in our recommendations and join with us to make the recommendations a reality. The changes envisioned by this report are well within reach, but will not be attained without a collective effort to make the recommendations happen. Even after the recommendations have been implemented, it will be necessary to work diligently to ensure that the changes reach the level of acceptance and success that we expect. Together we can.

# Appendix I
# Additional Recommendations

The Task Force spent more than a year meeting to discuss a broad range of issues relating to the development and retention of knowledge-based businesses and the training of knowledge workers. The *Recommendations Section* of this report identified the issues of highest importance to the establishment of a knowledge-based economy. There were a number of issues that the Task Force felt important enough to address in the report, but separate from the critical issues identified in the *Recommendations Section.* Following are four ideas that should also be considered for further action:

1. **Amend the Technical Careers Student Loan Forgiveness Program**. This program, begun in 1999 by the Arkansas Department of Workforce Education, targets high-growth job fields to ensure that Arkansas has a workforce prepared for these high-demand jobs. As currently written, the benefits of this program can be claimed only by Arkansas residents who work for an Arkansas company ($2,500 a year of loan forgiveness for each year worked, up to four years). **The Task Force recommends that the law be changed to allow non-residents to qualify for the program.** They would still have to work for an Arkansas company to receive benefits, thus allowing for an expansion of the state's workforce and the recruiting of highly educated individuals in critical areas.

2. **Use scholarships to help keep students engaged in high priority fields of study.** The Task Force supports a high standard for students to earn a college scholarship. Due to the fact that most scholarships require a 3.25 or higher grade point average to maintain a scholarship, it is a deterrent to students enrolling in some of the more rigorous disciplines. **The Task Force recommends that the entry level for scholarships be maintained, but for those students majoring in math, science or engineering, consideration be given to maintaining the scholarship with a grade point lower than required for other disciplines.**

3. **Establish professional interaction between high school math/science faculty and the faculty of local colleges and universities.** The Task Force often discussed how to improve the math and science skills of the students who will hopefully be enrolled in our colleges and universities. The Task Force believes that positive results will occur from a strengthened relationship between secondary schools and higher education institutions. **Therefore, the Task Force recommends that one faculty member from each middle school/high school be designated as the math/science liaison and that the liaison should work to establish a relationship with the math/science faculty at the nearest college or university.**

4. **Target a better utilization of the skills of returning native Arkansans.** For years Arkansas has exported some of its best and brightest students who left to work in other states. Many of these students have had significant achievements in their work in other states and are looking to return to Arkansas for a variety of reasons. **The Task Force recommends that to increase the supply of knowledge-based workers, the state consider an incentive that motivates native Arkansans with at least a four-year degree to return to Arkansas to take a knowledge-based job.**

# Appendix II
# Positive Trends

There is a critical need for quick action to address the growing problems of Arkansas' knowledge-based companies and our state's economic health. This critical need must also take into consideration the growing number of "things that are working" within our state. The Task Force spent hours discussing the positive activities already underway and, in fact, developed its recommendations after an analysis of those positive elements.

Indeed, there are many elements of a holistic, knowledge-based ecosystem already in place and thriving in Arkansas. Many of these elements are education-based and have established a good footing upon which a comprehensive system might be developed. The Task Force recognizes the overwhelming importance that education, research and entrepreneurial activities play in building a sound economy and want to highlight some of the innovations that are contributing to an expansion of Arkansas' knowledge-based jobs.

## Positive Trends From Arkansas' K-12

The SmartStart and SmartStep programs, aimed at providing Arkansas students with the basic education skills needed to be a successful student, have been critical in terms of giving our students the types of programs they need in elementary school and the foundation needed to excel in the tougher courses in high school and college.

The establishment of the Arkansas School for Math and Sciences has proven to be successful, especially in terms of providing students from smaller school districts an opportunity to participate in math and science curricula and activities that are normally not available in smaller schools. It continues to produce outstanding graduates who excel academically and present an image not usually associated with Arkansas high school graduates.

One area where Arkansas leads the nation is in the proliferation of Environmental and Spatial Technology (EAST) labs. There are more than 100 EAST labs in Arkansas high schools, and students involved in EAST programs continue to amaze educators and businesspersons alike in the innovative approach they have utilized in addressing community problems and needs. One of the most exciting parts of the EAST lab experience has been the impact this program has had on students who may not have been recognized as academically advanced. They have blossomed when allowed to participate in the EAST environment and utilize the high-end computer and software programs provided in the EAST labs. The EAST programs provide the state with an excellent foundation upon which we can grow these programs and continue to enhance their value.

Act 453 of 2001 provides $250,000 in grant funds that will allow 50 to 75 projects to be funded to purchase science equipment in the public schools. This is a small, but important step in focusing more attention on the need for science education. The real key in our state's potential for economic advancement centers on our current ranking at the bottom of the Milken Study, which indicates the low percentage of the Arkansas populace with a college education. To thrive in a knowledge-based economy, our

citizens must adopt a new attitude of encouraging our young people (and our adults) to attend college.

## Positive Trends from Higher Education

Recognizing the impact of the Milken Study's statistics, the Task Force also took time to review the broad scope of positive activities underway in Arkansas' technical colleges and universities.

Arkansas' two-year colleges have taken a leadership role in the establishment of Cisco Academies to train people in the installation, maintenance and service of information systems. The technicians who graduate from these academies will complement the efforts being made at the four-year schools to provide a trained workforce for our changing information-age economy.

The Genesis Incubator, located near the campus of the University of Arkansas at Fayetteville, is the lone survivor of an experiment in the mid-1980s to establish six business incubators in various locations throughout the state. The success of the Genesis Incubator is directly related to policies and practices that encourage faculty to turn the results of their research into businesses. There have been a number of successful graduates of this program and there are several current tenants who hold great promise for job creation in exciting, technology-oriented fields if we can keep these businesses in the state.

The University of Arkansas at Fayetteville has also taken a leadership role in the establishment of the Arkansas Research and Technology Park (ARTP), which will be located adjacent to the Genesis Incubator. The ARTP is an effort to jumpstart formation of the knowledge-based economy in Arkansas by creating the clusters of expertise necessary to nurture and grow knowledge-based industries. In addition to the monetary benefits that come from construction and job creation, the non-monetary benefits include the creation of an entrepreneurial culture capable of translating the intellectual property created by the university into the formation of new, knowledge-based industries.

Another bright spot with regard to progress made in the state toward improving our standing as a state focused on research is the establishment of the UAMS Biomedical Biotechnology Center in 1994 and more recently Arkansas BioVentures incubator on the campus of the University of Arkansas for Medical Sciences. It has enjoyed great success in its short life, spinning out nine companies from the incubator with several more in the pipeline. The UAMS BioVentures incubator will be an important generator of economic development in the state and will take advantage of the state's strength found in the doctors and scientists at the University of Arkansas for Medical Sciences, the University of Arkansas at Little Rock, Arkansas Children's Hospital, the Veteran's Administration hospitals and the National Center for Toxicological Research.

The establishment of the Donaghey College of Information Sciences and Systems Engineering (the CyberCollege) at the University of Arkansas at Little Rock is seen as another major positive step toward meeting the employment needs of information technology companies in Central Arkansas. The collaboration between education and business in designing the curriculum for this new college presents a template that might be followed in future attempts to structure college programs to meet the needs of business. The CyberCollege is cooperating with UAMS and UAF's Genesis Incubator in

a major federally funded Biomedical Research Infrastructure Network grant for bioinformatics research in a unique partnership approach. In just three year's time, the CyberCollege has proven its ability to fulfill its potential to change economic opportunities in the state. More than 700 students are enrolled in degree programs and almost 500 more take classes in the college. With the growing popularity of the CyberCollege's information technology minor, information technology certificate and project management certificate, classroom space has been exhausted; and a new CyberCollege building is now on the drawing board.

## Positive Trends from Expanded Research

A very important factor in the creation and retention of knowledge-based jobs is the degree to which the state is involved in research that leads to innovations and the creation of new businesses. Arkansans need to better understand and appreciate this important linkage. As indicated earlier, our universities are making important strides in the areas of applied research linked to technology and job creation.

Although the state is consistently ranked among the lower tier of states in research-oriented indicators, Arkansas has taken some necessary steps to improve that ranking. The Arkansas Science and Technology Authority (ASTA) was established in 1983 to provide a focal point for science and technology issues in the state. ASTA offers assistance in the funding of basic and applied research and also manages a seed capital investment fund. The Seed Capital Program was initially funded at $1.8 million and its worth is now about $4 million. It is very close to being fully invested.

Along with the basic and applied research programs, the Seed Capital Program has allowed some of the companies that have come out of our state universities to turn the results of their research into businesses employing Arkansans. Most of these businesses have been knowledge-based, requiring highly educated employees and paying wages significantly above the average.

In 1999, the Arkansas General Assembly established the Arkansas Research Matching Fund through Act 1545. For the first time, the state of Arkansas appropriated funds to allow our colleges and universities to compete for federal research dollars. The results were dramatic in terms of the percentage of federal research dollars received by the state. Unfortunately, this fund was not replenished during the 2001 session of the General Assembly. A permanent source of revenue for this fund is essential if our colleges and universities are to aggressively participate in efforts to bring federal dollars to the state for research. Hopefully, this will be a priority during the 2003 legislative session.

## Positive Trends from Entrepreneurial Activities

Another indicator often used to gauge a state's progress in economic development is the extent to which entrepreneurial activities are encouraged and nurtured. There is still much to do in this area, but significant progress has been made and new developments hold great promise for raising our state's score.

A key new development in the effort to grow high-tech companies in Arkansas can be found in the establishment of the Innovation Incubator program initiated by the University

of Arkansas at Fayetteville. This program provides cash vouchers, salary and tuition for graduate students and access to university research equipment to assist promising start-up companies. It is open to both university faculty as well as individuals and companies statewide. It is a great example of how the state is starting to nurture these knowledge-based companies.

Arkansas Capital Corporation has initiated an annual business plan competition among Arkansas' college students. The Governor's Award for Entrepreneurial Development is presented to the winner of this competition each spring. This competition is an excellent beginning to the creation of an environment on Arkansas college campuses that encourages students to develop the skills needed to determine the viability of a business idea.

A key element that has been missing from the entrepreneurial equation in Arkansas is the lack of venture capital to keep new, knowledge-based businesses in the state. Late in the legislative session of 2001, there were two vital pieces of legislation enacted to help correct this deficiency. Act 1791 authorized the Arkansas Development Finance Authority (ADFA) to establish a "fund of funds" venture capital investment group that will finance targeted and approved venture capital funds in the state. ADFA is authorized to finance up to $70 million in viable venture capital investments. A complementary act, Act 1584, allows investors who hold their investments in certain technology areas for at least five years to be exempt from the Arkansas capital gains tax on profits realized from these targeted investments.

# Appendix III
# Recommendations
## on Science, Math, Engineering and Technology Education to the Arkansas Blue Ribbon Commission on Public Education

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The Task Force shared some thoughts about science, math, engineering, and technology (SMET) education that it considers important with the Blue Ribbon Commission prior to the issuance of the Commission's report. The list is grouped to address students, teachers, infrastructure, research on education, the Department of Education, and partnerships.

**Students:** *(Students are what public education is all about.)*

- Maintain through middle and high school grades students' early natural curiosity about science by emphasizing incremental, "clinically" tested improvements in math, science, pre-engineering and technology curricula.
- Build strength in SMET by building on the educational foundation established through Comprehensive Early Literacy, Smart Start, Smart Step and Next Step.
- Provide hands-on, open-ended, real-world problem solving linked to the curriculum. Use engineering modules. Group by discipline and level of difficulty.
- Promote science fairs in middle school grades and make science fairs more appealing.
- Recognize and reward students who excel in academics.

**Teachers**: *(Nothing beats having a first-rate teacher in the classroom.)*

- Improve science teaching dramatically.
- Increase the number of SMET teachers through:
  - Scholarships (pre-service);
  - Student loan forgiveness;
  - Bonuses; and
  - Tax incentives.
- Increase the quality of SMET teachers through:
  - Increased SMET coursework (pre-service);
  - Alternate certification and transition to teaching assistance;
  - Differential pay for SMET teachers;
  - Improved in-service training about how students learn;
  - Improved professional development that focuses on the SMET curricula; and
  - Teacher mentoring.

**Infrastructure:** *(Twenty-first Century organizations must have access to 21st Century infrastructure.)*

- Deploy current technology.
- Provide teaching materials (including on-line resources).

**Research on Education:** *(We wouldn't think about giving our children drugs that had not been clinically tested. Why do we accept teaching practices that have not been tested and found to be effective? )*

- Increase research on SMET teaching and learning.

- Cultivate effective teaching methods based on solid information about what works and what doesn't.
- Propose, evaluate and disseminate best practices in teaching SMET.

**State Department of Education:** *(The Department's mission is to provide the highest quality leadership, service and support to school districts and schools so they may provide equitable, quality education for all students in Arkansas public schools.)*

- Adopt a pre-engineering curriculum.
- Support regional SMET magnet schools.
- Use private sector and non-governmental organizations to set SMET curricula and high performance standards.
- Disseminate best practices (to schools).
- Maintain on-line SMET curricula.
- Maintain a centralized Web site.
- Provide public outreach and parental educational materials.
- Stress the importance of four-year degrees.
- Back high standards; resist pushback when performance scores are low.
- Develop better assessment mechanisms.
- Employ an adequate number of science coordinators so that science coordinators are readily available to all schools.
- Use current funds more efficiently by redirecting support to academic areas of need.

**Partnerships:** *(Partnerships have always been important. In the context of the Knowledge-Based Industries Task Force, partnerships are important because it is apparent that the public education enterprise can't improve SMET alone. The partnerships need to focus on science and engineering organizations that have something to contribute.)*

- Provide a source of real world problems (e.g., for EAST students).
- Illustrate the pipeline/continuum/jumping-the-gap issues between middle school, high school, college, university and graduate school, and between education at every level and the workplace. These skill-building issues are especially prominent regarding science (i.e., science fairs, where students explain their observations by using math), technology (i.e., EAST, Cisco, and ExplorNet), and pre-engineering (e.g., robotic competitions).
- Underscore the importance of four-year degrees.
- Provide leadership in doing a better job honoring students who excel at academics.
- Promote and share best partnership practices.
- Recognize and reward partnership involvement.
- Provide support or incentives for partnerships between schools and the following:

| Universities | Companies | Non-Governmental Organizations. |
|---|---|---|
| • Provide liaison with local high schools.<br>• Offer summer research experiences for teachers and students. | • Adopt a local school.<br>• Offer summer extern-ships to teachers.<br>• Provide training, financial support and equipment donations. | • Work with teachers, schools and students. |

# Appendix IV
# Members
## of the Task Force for the Creation of Knowledge-Based Jobs

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The following persons are members of the Task Force who have worked for more than a year to offer the recommendations included in this report. They have worked tirelessly to address this critical need in Arkansas' economic development strategy and are to be commended for their effort.

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